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(لنډيز)

په افغانستان کښې دغلې دلږ والي له کبله حکومت په غنمو وجوارو باندې د کيمياوي سرې استعمال ضروري کار بللی دی.

دافغانستان دغلې زياتوالی له دوه لارو په اساسي توګه لاسته راتلای شي چه يو يې دکيمياوي سرې استعمال اوبله يې داصلاح شوو تخمونوکرل دی.

په افغانستان کښې کله کله بزګر فکرکوي چه کيمياوي سره په وطني فصل باندې ښه اغېزه نه لري بلکه دغه سره کله کله خاوره خرابوي مګر دغه يو غلطه فکوره ده.

په دې کتنه کښې په وطني جوار باندې دکيمياوي اووطني سرې تاثير ترمطالعې لاندې نيول شوی دی اوداثابته شوه چه کيمياوي سره له وطني سرې نه ډېره اقتصادي ده په تيره بياهغه بزګرو دپاره چه وطني سره مخولس په لس روپۍ اخلي.

له دې کتنې څخه معلومه شوې ده چه دوطني جواردپاره په يو جريب کښې ۱۲ کيلو ګرامه نايتروجن اوفاسفورس (P_2O_5) يوه ښه اندازه ده.

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INTRODUCTION

Corn, which serves as a source of food for human beings and as feed for livestock, ranks next to wheat in importance in Afghanistan. This cereal crop is especially important in the Logar, Jalalabad, and Helmand Valley agricultural areas. The yield of corn varies greatly with the variety, plant population, and rate and method of application of commercial fertilizer.

Today only a few farmers in Afghanistan are using commercial fertilizer on corn. Some investigators report there is no response by local corh to commercial fertilizer, however, many farmers in Afghanistan are using a combination of different fertilizing materials known as "local fertilizer" (3 and 8). These materials consist of animal manure, night soil, ashes, mud from old walls and ditch sediment or fertile soil. With the use of "local fertilizers" farmers in most provinces can produce corn yields up to 6840 kg/hectare.

The objective of this project was to determine the effects of nitrogen fertilizer alone, nitrogen and phosphorus fertilizer at varied rates in combination, and "local fertilizer" upon the yield of native corn.

REPORTS OF CORN FERTILIZATION

The results of some research done in Afghanistan and under related conditions abroad is summarized in this paper. This supplements the older report by Naitaqi and Nielsen (3) which also reviews fertilizer response on corn.

Shuman (8) reported a non-replicated experiment with hybrid corn in the Kabul area in 1959. He found that commercial fertilizer increased the average yield of four hybrid varieties to 1331 kg/hectare and for each afghani spent on fertilizer he received a net return of 2.7 afghanis. He also reported that the local corn did not show an increased yield although fertilized in the same manner as the hybrids.

An experiment conducted at the Faculty of Agriculture in 1963 showed that green manure treated plots yielded 50% (1351 kg/hectare) more grain than the control plots and the plots with plant populations of 58,000 plants per acre yielded 250% (3906 kg/hectare) more than did the plots with 72,500 plants per acre.

Pickett, _et al._, (4) experimented with 48 randomized plots at Darulaman Farm (Ministry of Agriculture Najar Khana) in 1965. They concluded that plant population affected the yield of corn as much or more than fertilizers. Commercial fertilizer proved to be economically feasible but green manure did not.

Samin (7) sampled fifteen corn fields in Logar and Kabul provinces in 1965 and 1966. He found the average yield to be 3687 kg/hectare. The poorest

yield was 2154 kg/hectare and the best yield was 7154 kg/hectare or 114 bushels per acre, this being the highest yield of local corn reported in Afghanistan to date. The plant population ranged from 43,400 to 69,800 plants per acre in the fifteen tested fields.

Fertilizer recommendations of RGA Ministry of Agriculture were distributed in 1967 (6). The recommendation for corn was 160 kg/hectare of superphosphate and 52 kg of urea/hectare at planting and 57 kg of urea at the time the plants reach a height of 8-10 inches. They also recommended planting three seers of local corn/jerib.

A 1961 semi-annual report of the Wyoming Team (10) reported a 24-treatment trial at Bolan Station. Ammonium nitrate and treble superphosphate were hand-applied using Logar seed corn. The highest yield was 4910 kg/hectare (135 seers/jerib), obtained from a treatment in which 180 kg N and 135 kg P_2O_5/hectare were used.

In the summer of 1966 HAVA extension agents in the Helmand Valley conducted 62 one-half acre demonstrations on cooperating farmers' fields. This project was assisted by D. P. Carter (2). The fertilizers used in this investigation were diammonium phosphate (21-53-0) and urea (45-0-0). The rates were 51 kg N/hectare and 47 kg P_2O_5/hectare. The fertilizers were applied at planting time. They reported yields as follows:

	Surecropper	Local Variety
	. . . . . . kg/hectare	. . . . . .
Planted in rows, fertilized	3026	1601
Planted in rows, not fertilized	2442	1212
Broadcast planting, fertilized	2787	2065
Broadcast planting, not fertilized	2393	1532

Two of the farmers' best yields exceed 6278 kg/hectare (100 bu/acre). The Kajakai area farmers who grew the corn commercially got more than double the best yield they had ever obtained. They concluded that the change in variety alone gave a 55% increase in the yield and fertilizer increased the yield 22.5%.

Carter (1) reported on local corn in comparison to Surecropper in Helmand Valley where 100 kg N/hectare and 48 kg P_2O_5/hectare were applied. He concluded that 50-60% more yield was obtained by the use of fertilizer and a change in variety alone almost doubled the yield. To change the variety and add fertilizer almost tripled the yield. Local corn returned 2.5 times the fertilizer investment while Surecropper gave almost a four-fold return.

Sidiki, *et al.*, (9) conducted three sets of experiments with nitrogen, phosphorus and potash under different combinations during 1961-63 in the Nawabshah district of Pakistan. The results of 67 trials are summarized in Table 1.

Table 1. Calculated average yield of corn grain in 67 trials in the Nawabshah district, West Pakistan.

Treatment	Yield	Increase in Yield Over Control
. . . .	kg/hectare	. . . .
SET I		
1. Control	1383	---
2. 67 kilograms of Nitrogen	1660	277
3. 67 kilograms of Nitrogen and 76 kilograms of P_2O_5	1789	406
SET II		
1. Control	1253	---
2. 67 kilograms of Nitrogen	1577	324
3. 67 kilograms of Nitrogen and 50 kilograms of P_2O_5	1706	453
SET III		
1. Control	1134	---
2. 67 kilograms of Nitrogen	1392	258
3. 67 kilograms of Nitrogen and 76 kilograms of P_2O_5	1567	433

In all three sets superphosphate was applied before planting. The application of ammonium sulfate was split with one-half applied at sowing and one-half at the time of the first irrigation.

EXPERIMENTAL METHODS

A total of 48 individual experimental plots measuring 5 x 10 meters each were established in Fields 2 and 5 at the University Darulaman Farm. The soil was clay-loam with a pH of saturation paste of 8.1, electrical conductivity of saturation extract of 1.1, available phosphorus content of 5 ppm, nitrogen content of .102% and organic matter content of 2.04%.

Soil treatments were replicated three times in each of the two fields as follows:

1. Check.
2. 52 kg of Nitrogen/hectare.
3. 104 kg of Nitrogen/hectare.
4. 156 kg of Nitrogen/hectare.
5. 104 kg of Nitrogen and 104 kg P_2O_5/hectare.
6. 156 kg of Nitrogen and 104 kg P_2O_5/hectare.
7. 156 kg of Nitrogen and 156 kg P_2O_5/hectare.
8. 100 donkey loads of local fertilizer/jerib (517 loads/hectare).

Urea and superphosphate were the sources of nitrogen and phosphate.

Plowing and malaing were done by a local farmer. Local seed corn from Logar Province was selected and broadcast according to the common native method on May 23 in Field 2 and May 31 in Field 5.

The "local fertilizer" was applied to both fields before irrigation and stick plowing. The commercial fertilizer was broadcast after irrigation and on the same day as the plantings took place. Basin irrigation was practiced on all plots.

Thinning was accomplished when the plants were about one foot in height. The most experienced farm laborer thinned all plots to populations of 58,000-64,000 plants/acre in Field 2 and 65,000-74,000 plants/acre in Field 5.

During the early growing season phosphorus deficiency symptoms were observed in most plots. The check plots indicated a greater deficiency. A considerable amount of soil variability was evident in Field 5.

One additional replication of the same eight treatments was mechanically planted and fertilized in Field 5 adjacent to the three native-planted replications. Here each plot consisted of six 30-inch by 50 meters long rows. Planting date was June 7. Border-dike irrigation was practiced even though

the corn was planted in rows. No attempt was made to obtain a plant population identical to the adjacent native-planted plots. Nevertheless, a uniform stand was obtained.

A composite soil sample from Field 2 was brought to the laboratory and used to fill eight identical pots. The pots were planted to native corn with each receiving treatments identical to those used in the field. Yield data of total dry matter of plant material from each pot was obtained. The pot trials and the mechanical replication represent unreplicated trials.

RESULTS

Yield results of eight fertilizer treatments replicated three times in each of two fields are shown in Table 2 and Figure 1. Plots having 104 kg each of N and P_2O_5/hectare gave the highest yield in both fields. In Field 2 this treatment produced 4705 kg/hectare whereas the control treatment plots produced only 3308 kg/hectare. In Field 5 it produced 5951 kg/hectare with the control producing 4199. Plots having 104 kg of N alone produced 3458 kg/hectare in Field 2 and 4620 kg/hectare in Field 5. It appears there is a response from phosphorus fertilizer as plots having 104 kg each of N and P_2O_5 outyielded the plots which had only the 104 kg of nitrogen.

The yield results of the one mechanized replication and the pot trials are reported only as comparative yields on page 6, Figure 2.

Table 2. Mean yields of shelled corn as influenced by fertilizer treatments.

Treatment	Field 2	Field 5
	..... kg/hectare	......
Check	3308 e	4199 d
52 kg N/h	3524 cde	4311 cd
104 kg N/h	3458 e	4620 cd
156 kg N/h	4049 bcd	4845 bcd
104 kg N and 104 kg P_2O_5/h	4705 a	5951 a
156 kg N and 104 kg P_2O_5/h	4574 ab	5342 ab
156 kg N and 156 kg P_2O_5/h	4049 bcd	4236 d
100 donkey loads of local fertilizer	4142 b	4930 bc

Note: Mean value of three replications in each field. Any two means in the same column and not followed by the same letter are significantly different at the 0.05% level of probability. Data for each field was analyzed separately.

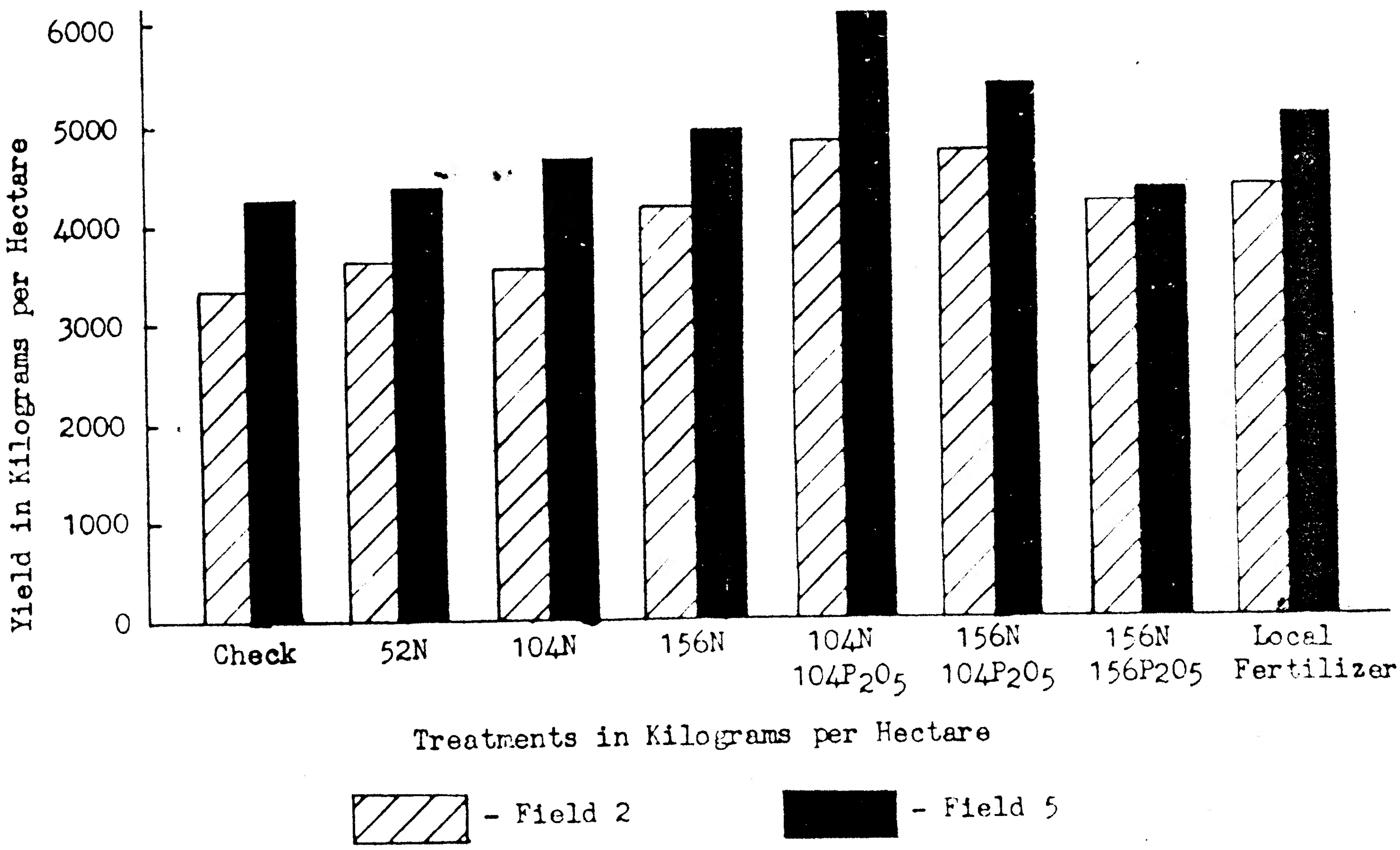


Figure 1. Average shelled corn yield of 3 replications in Fields 2 and 5 at Darulaman Farm - 1967.

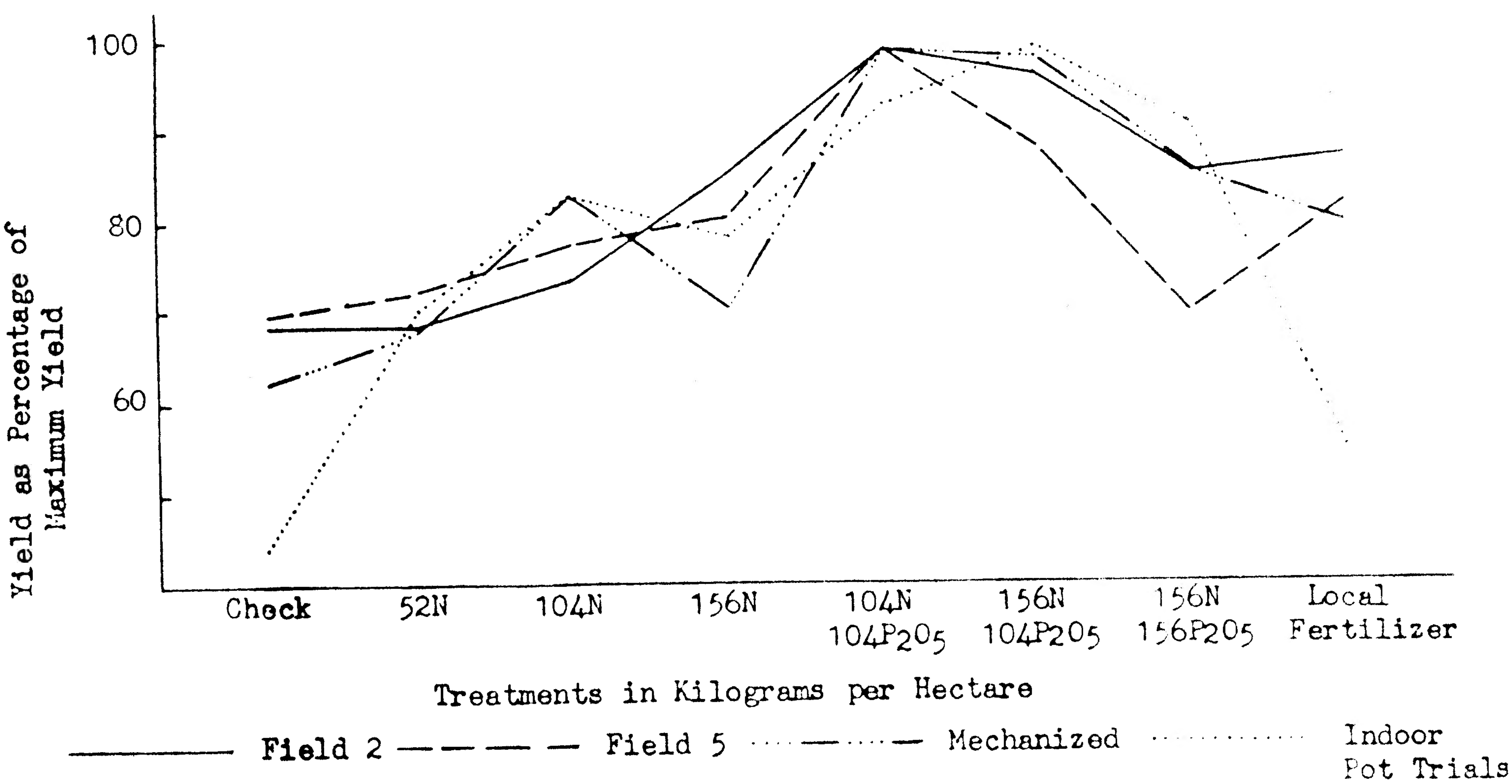


Figure 2. Comparative yields of shelled corn in Field 2, Field 5, a mechanized replication and the indoor pot trials.

Location	Treatment No.	Fertilizer Applied per Hectare N	Fertilizer Applied per Hectare P_2O_5	Corn Yield per Hectare Unferti-lized	Corn Yield per Hectare Ferti lized	Increase in Yield per Hectare Amount	Increase in Yield per Hectare Percent	Net Return from Fertilizer per Hectare	Net Return from Fertilizer per Af Invested	Increase in Yield per Kg Nutrient	Source
		. . . .	. .	Kg.	. . . . .	. . . .		. . . . Afs.	. . . .	Kg	
Field 2 Darulaman Farm (Av. 3 replications)	1	52	0	3308	3524	216	6.5	776	1.5	4.2	Samin
	2	104	0	3308	3458	150	4.5	-140	-0.13	1.4	
	3	156	0	3308	4049	741	22.4	2886	1.9	4.8	
	4	104	104	3308	4705	1397	42.2	6094	2.7	6.7	
	5	156	104	3308	4574	1266	38.3	4788	1.7	4.9	
	6	156	156	3308	4049	741	22.4	1014	0.3	2.4	
	7	100 donkey load local fertilizer/ jerib		3308	4142	834	25.2	4	0.001	---	
Field 5 Darulaman Farm (Av. 3 replications)	1	52	0	4199	4311	112	2.7	152	0.3	2.2	
	2	104	0	4199	4620	421	10.0	1486	1.4	4.0	
	3	156	0	4199	4845	646	15.4	2316	1.5	4.1	
	4	104	104	4199	5951	1752	41.7	8224	3.6	8.4	
	5	156	104	4199	5342	1143	27.2	4050	1.4	4.4	
	6	156	156	4199	4236	37	0.9	-3210	-0.9	0.12	
	7	100 donkey load local fertilizer/ jerib		4199	4930	731	17.4	-614	0.10	---	
Kabul				--	--	--	--	--	2.7	---	Shuman(8)
West Pakistan	Set 1	67-0-0		1383	1660	277	20.0	992	1.5	4.1	Sidici(9)
		67-76-0		1383	1789	406	29.4	854	0.59	2.9	
	Set 2	67-0-0		1253	1577	324	25.8	1274	1.9	4.8	
		67-50-0		1253	1706	453	36.2	1448	1.14	3.87	

Ministry of Agriculture, farmer fertilizer cost in Afs per Kg: N, 10; P_2O_5, 12. Each donkey load of local fertilizer was valued at 10 Afs. Bazaar corn price equaled 6 Afs/Kg.

DISCUSSION

This study was conducted to compare the increase in corn yields through the use of commercial and "local fertilizers." The results of this project represent a one-year trial using a single local variety of corn. Since the project was conducted in only two fields at the University Farm, strong conclusions should not be drawn.

Four Local Fertilizer Problems and Their Possible Solutions

1. The determination of the optimum rate of the fertilizers for corn is a project that will probably never be completed. Results should not be extended from one variety to another or from one province to another. More research is needed to find at least a tentative rate for the future. Under similar soil conditions and cultural practices, and until further research results become available, it would seem advisable to apply about 20 kg N and 10-20 kg P_2O_5 per jerib. All of the phosphate and one-half of the nitrogen should be applied at planting time and the other one-half of the nitrogen at the first irrigation.

2. As corn yields are increased by heavy application of nitrogen and phosphorus, deficiencies of zinc and potassium may occur. Large applications of phosphate fertilizer may promote the formation of insoluble zinc phosphate and will lower zinc availability. Extractable potassium is generally abundant in Afghan soils but sustained high yeilds of corn could remove this nutrient at a rate faster than it could be replaced by the natural decomposition of mica and other soil minerals rich in "bound" potassium.

3. The time and method of applying fertilizer can greatly affect results and should therefore receive more attention. Some more research is needed to compare the relative merits of concentrating fertilizer in a band or row versus broadcasting which thoroughly mixes the fertilizer with the soil.

4. In this project the "local fertilizer" on local corn was not as economical as commercial fertilizer. More research using many replications is needed to further assure that commercial fertilizer will economically increase the yield of local corn. Perhaps the local variety should be replaced by an introduced variety. The farmers of Afghanistan have a lifetime of experience with local corn varieties and "local fertilizers" and may resist this change.

SUMMARY

Plots having urea and superphosphate applied at the rate of 104 kg each of N and P_2O_5 per hectare had average shelled corn yields of 42.2 and 41.7 percent greater than check plots in two fields at the Faculty of Agriculture's Darulaman Farm. Although strong conclusions cannot be drawn, the most profitable rate in both fields was 104 kg each of N and P_2O_5 per hectare, giving a return of 6.7 and 8.5 kg of corn per kilogram of plant nutrient and corresponding net returns of 2.7 and 3.6 afs per afghani invested in fertilizer.

"Local fertilizer" at a price of 10 afs per donkey load was not economical in either field. This indicates that it would be more profitable for farmers who are now buying "local fertilizers" at the price of 7-10 afs per donkey load to buy commercial fertilizers. For the farmers who have "local fertilizer" it probably would be advantageous to sell it and invest the sales money in commercial fertilizers. This definitely would not be an advisable practice unless the farmers always purchased the commercial fertilizer in return.

In this study the yield obtained by the use of commercial fertilizer on local corn compared favorably with the yield reported by Shuman (8) in the Kabul area and Sidiki (9) in Pakistan. There was a response of the local corn to phosphate fertilizer. Nitrogen alone was not economical.



FERTILIZER TRIALS ON CORN—1967

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